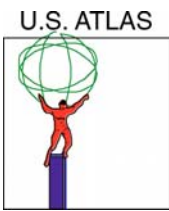


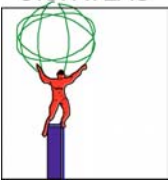
Tile Calorimeter

Larry Price



Outline

- **Organization**
- **System Overview**
 - ◆ **Achievements**
 - ◆ **Issues**
- **Construction Status**
- **Transition**



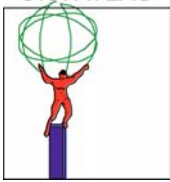
Organization

Institutions

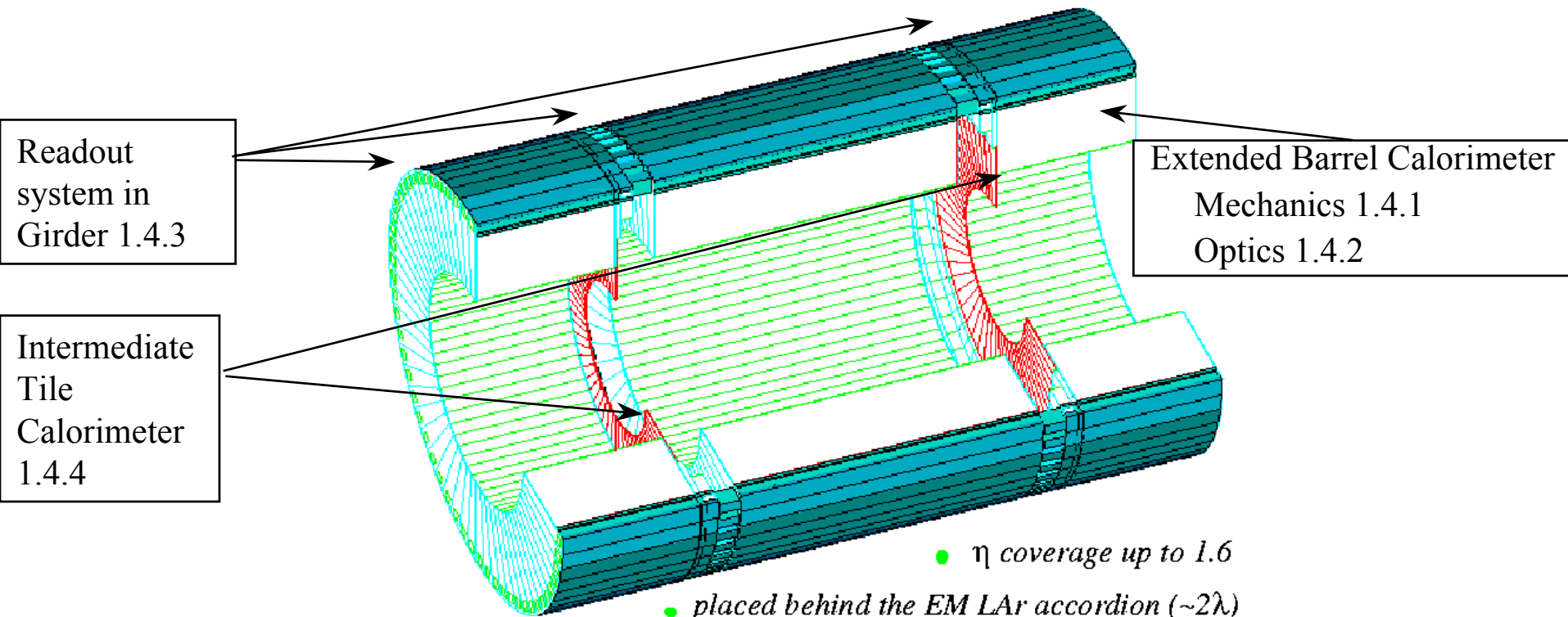
- **Argonne National Laboratory**
 - ♦ Mechanical design and analysis
 - ♦ Construction of submodules and modules
 - ♦ Instrumentation
 - ♦ Shipping
 - ♦ Test beam and calibration
- **University of Chicago**
 - ♦ Electronic design
 - ♦ Front end and interface board construction
 - ♦ Test beam and calibration
- **University of Illinois**
 - ♦ Submodule construction
 - ♦ PMT purchase and testing
- **Michigan State University**
 - ♦ Instrumentation
 - ♦ ITC scintillator
- **University of Texas at Arlington**
 - ♦ ITC submodules and scintillator
 - ♦ PMT purchase and testing

Management

- 1.4.1 Mechanics (Proudfoot)
- 1.4.2 Instrumentation (Huston)
- 1.4.3 Readout (Errede)
- 1.4.4 Intermediate Tile Calorimeter (De)

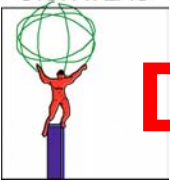


ATLAS Tile Calorimeter (1.4)



- outer diameter 8.5 m, 12.2 m long, 2900 tons, 64 wedges structure
- Fe-scintillator sampling calorimeter (ratio $\sim 4:1$), WLS fibres readout
- unconventional scintillator geometry, with tiles in the radial direction
- the calorimeter body and the massive iron outer support act as

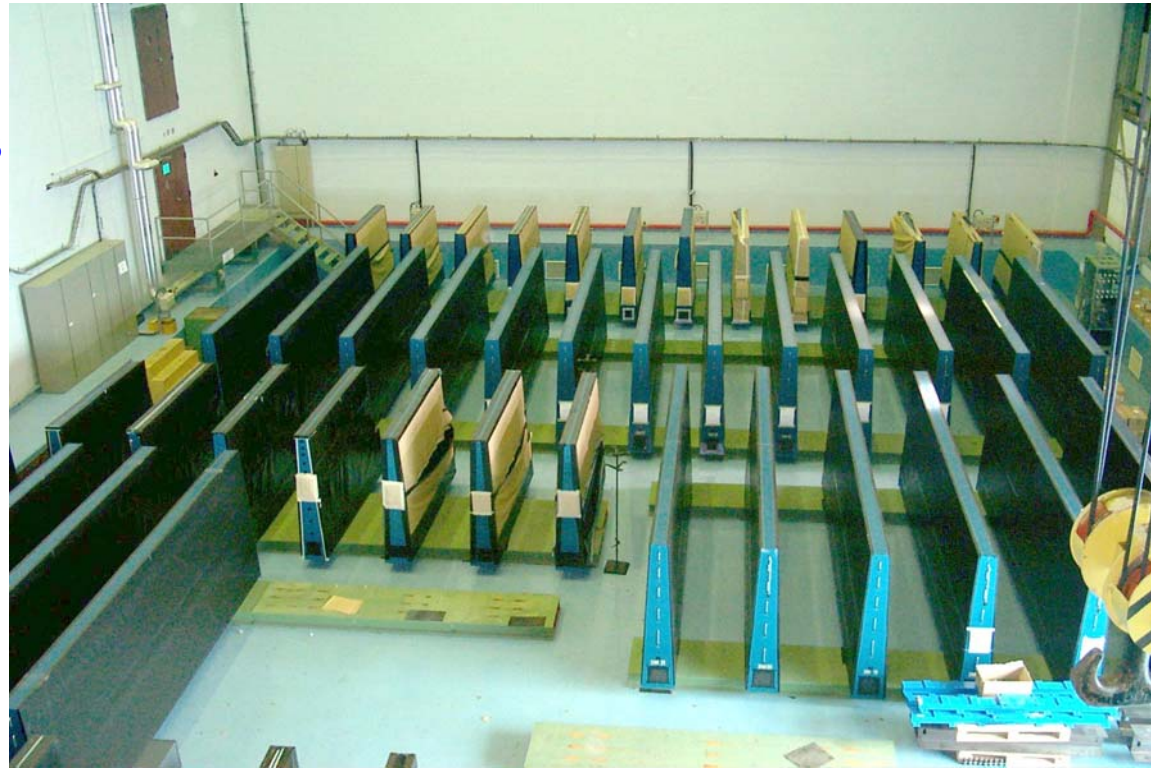
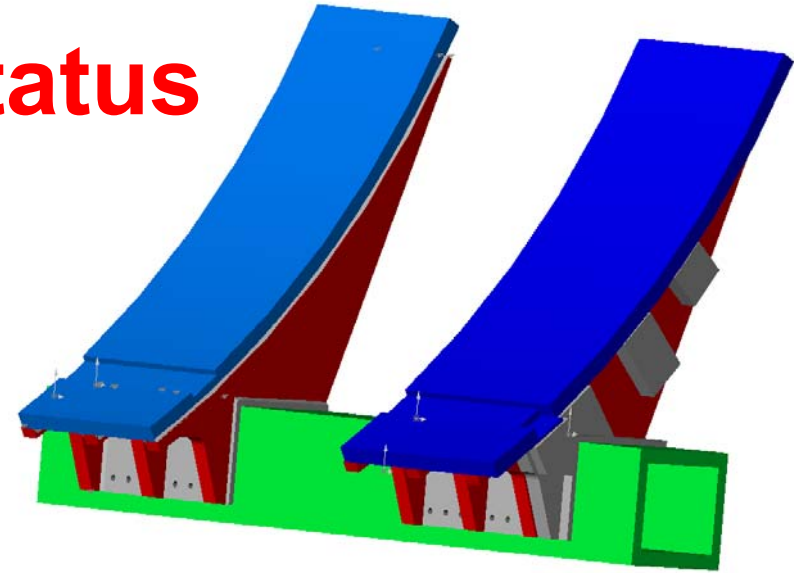
magnetic flux return for internal solenoid

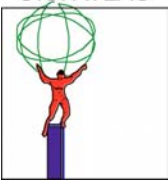


Deliverables and Status

• 1.4.1 Mechanics

- ◆ Submodule construction is complete
 - ▲ 596 total
- ◆ Girder production & delivery is complete
- ◆ All 65 modules mechanically assembled, instrumented, and tested
- ◆ 64+1 completed modules have been shipped to CERN
- ◆ Saddle design complete

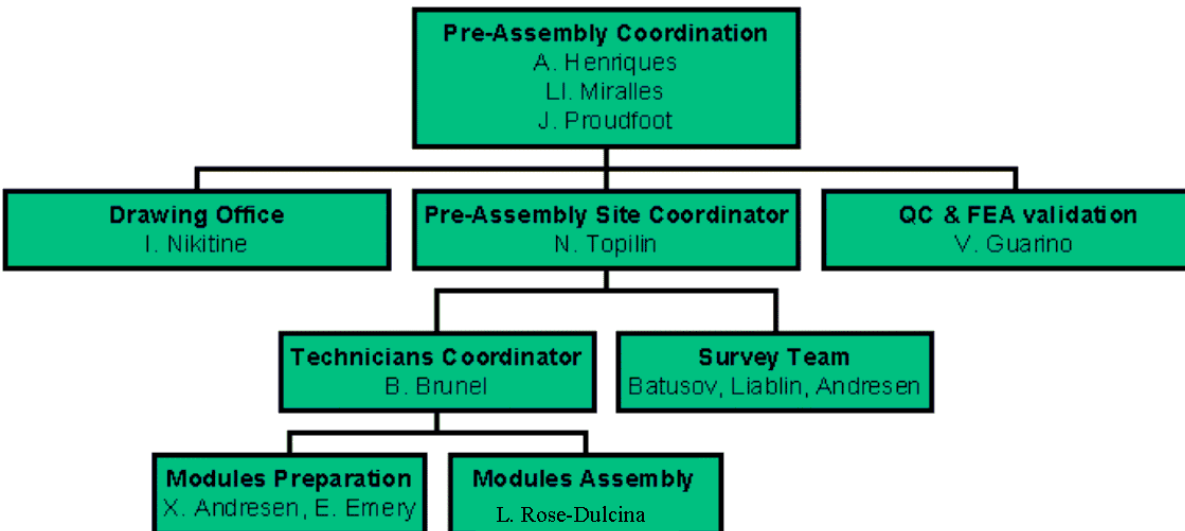


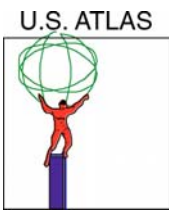


Deliverables and Status

• 1.4.1 Mechanics

- ◆ Installation tasks under way with preassembly in building 185 (compare pictures with previous page)
- ◆ EBC Preassembly is complete!
- ◆ First saddle is delivered, repaired, and incorporated in preassembly

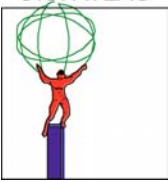




Deliverables and Status

- 1.4.2 Instrumentation
 - ◆ 64 EB modules completed (65 th shipped uninstrumented as backup)
 - ◆ All modules meet 10% uniformity specification
 - ▲ But a few early modules have been repaired at CERN

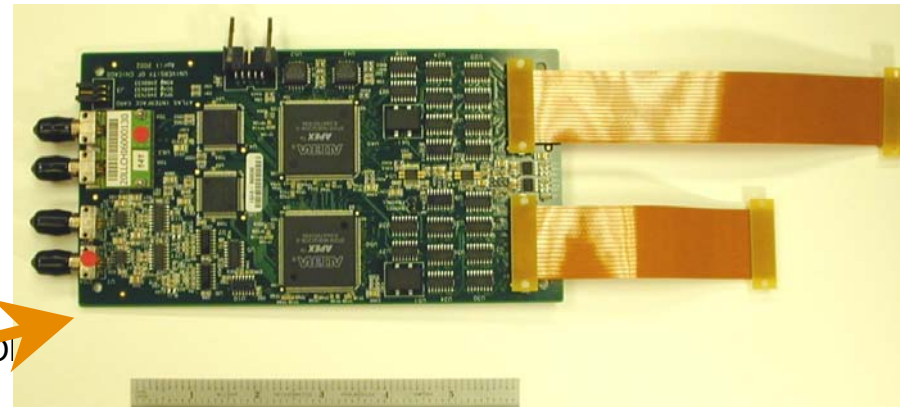


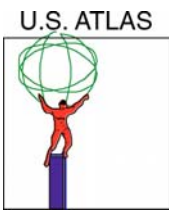


Deliverables and Status

• 1.4.3 Readout

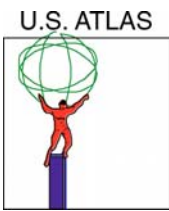
- ◆ STEP1 Testing completed for all 3500 Hamamatsu R-7877 PMTs (UI, UTA)
- ◆ STEP2 completed for all
- ◆ 69 PMTs rejected & replaced (~ 2%)
- ◆ Breakdown problem discovered in base
 - ▲ Presently program to repair all 10K bases (but not primarily in U.S.)
- ◆ Front end 3-in-1 cards (10,600) complete
- ◆ Mother Boards
 - ▲ All shipped, but TTC mezzanine boards being reworked to meet new specs of TTC chip
- ◆ Optical Interface Cards
 - ▲ All delivered
 - ▲ 100% tested and shipped to CERN





Deliverables and Status

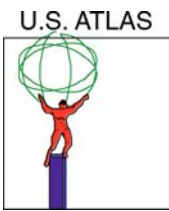
- **1.4.4 Intermediate Tile Calorimeter**
 - ◆ Finished submodule production in May, 2002
 - ◆ Built 2 spares in June
 - ◆ Have placed order for gap scintillator
 - ◆ Final drawings approved for crack (cryostat) scintillator boxes
 - ▲ Initial materials ordered



System Overview

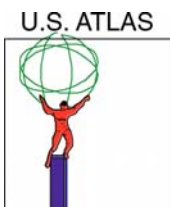
- **Issues**

- **Module construction in U.S. is complete!**
- **Potential concerns during preassembly and installation (low/moderate risk; U.S. does not have primary responsibility)**
 - **EBA & Barrel Saddle procurement**
 - **Cryostat interference**
 - **Cryostat loading during pre-assembly**
 - **Barrel cryostat supports and load test**
 - **EB cryostat support and load test**

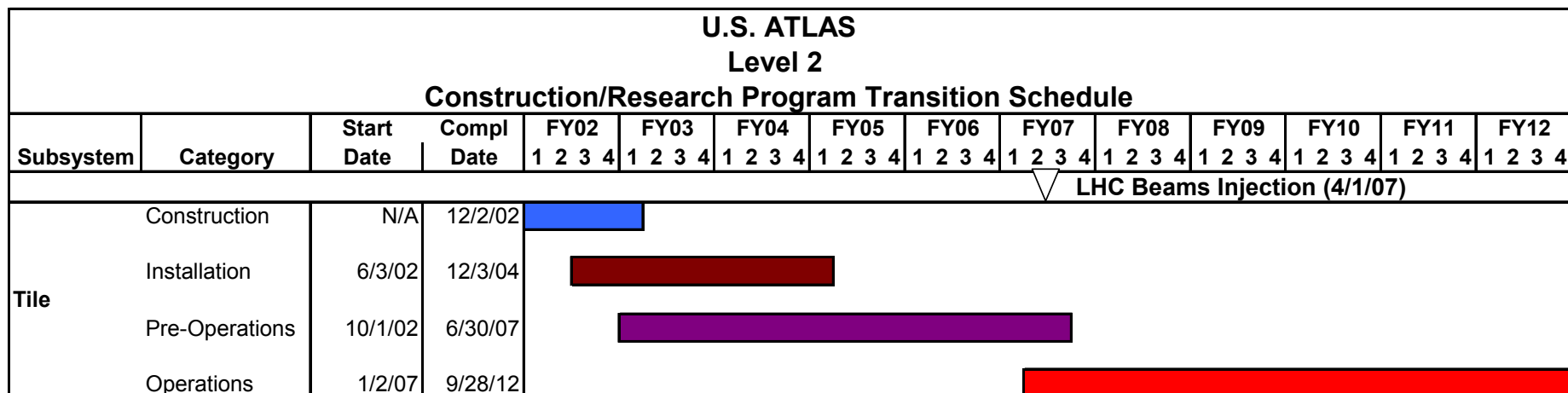


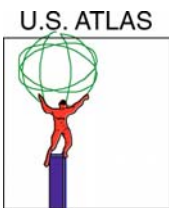
Tile Construction: What's Left?

- Complete rework and testing of TTCrx boards
- Gap scintillators
- Preassembly EBC 10/02 – 4/03
- Preassembly Barrel 5/03 - 12/03
- Preassembly EBA 2/04 - 6/04
- Install Barrel-EBC-EBA 5/04 – 11/05
- Commissioning and Testing 2002-2006
- LHC turnon 2007



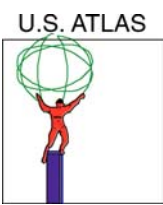
U.S. ATLAS: High Level Schedule



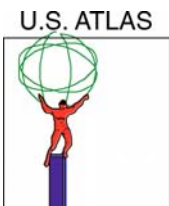


Conclusions

- Tile Calorimeter Module Production is complete
 - ◆ Module 65 + Tooling shipped out on April 30th
 - ◆ Module performance and beam/cesium calibration is meeting specification
- EBC Pre-assembly of cylinder complete
 - ◆ Comparison of measured module positions & inferred deflections to the FEA calculations is in progress
- Have completed several tasks in collaboration with ATLAS Technical Coordination
 - ◆ Now working on the movement hydraulic control system
- Have started on the NEXT phase of Tile Calorimeter construction.
 - ◆ Pre-assembly of Barrel and EBA cylinders in conjunction with cryostat load tests, with a comparison to FEA calculations
 - ◆ Module certification as part of Barrel and EBA pre-assembly -> this work leads directly into the work necessary to commission the calorimeter in the cavern
- We are on track to begin installation of the barrel in the ATLAS cavern in April 2004.



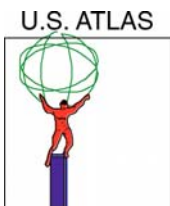
Tile Breakout



ETC 03 Cost Profile

Tile - WBS level 3

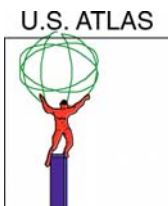
(Project AYk\$s)			
	Prel ETC03 Total Budget (ETC03 FY02-FY05 + Carryover)	Final ETC03 (FY03 - FY05)	
WBS	Total Budget (AYk\$s)	Total Budget (AY\$s)	Delta
141	200.5	760.28	(559.7)
142	87.7	69.71	18.0
143	290.3	290.40	(0.1)
144	420.9	170.70	250.2
Total	999.5	1,291.09	(291.6)



ETC 03 Cost Profile

Tile - WBS Level 3

Tile ETC 03 Profile (Project K\$s)				
WBS	FY03	FY04	FY05	Total
141	415.6	336.2	-	751.9
142	69.7	-	-	69.7
143	290.4	-	-	290.4
144	170.7	-	-	170.7
1.4 Total (FY03\$s)	946.5	336.2	-	1,282.7
1.4 Total (AY\$s)	946.5	344.6	-	1,291.1

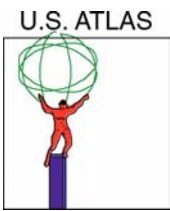


ETC 03

Institution Projection Totals by Year

ETC03 Funding Projections for Tile (Project k\$s)

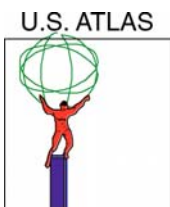
Institution	FY03	FY04	FY05	Total
ANL	305.2	152.5	-	457.7
Michigan State U.	174.7	45.6	-	220.3
U of Chicago e	88.9	-	-	88.9
U of Chicago m	-	19.3	-	19.3
U. of Chicago	-	99.4	-	99.4
U. of Illinois, Urbana-Champaign	288.5	-	-	288.5
U. of Texas at Arlington	89.1	19.5	-	108.6
Total	946.4	336.3	-	1,282.7



ETC03 Cost Profile

Tile - WBS Level 3

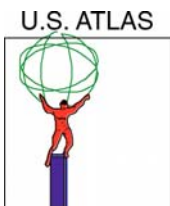
- Increased cost for ETC03 came mostly from newly-defined installation costs.



Tile Milestones

Level 2 Milestones

Subsystem	Schedule Designator	Description	ETC 02 Schedule Date	ETC 03 Schedule Date
Tile	Tile L2/1	Start Submodule Procurement	Complete	Complete
	Tile L2/2	Tech Choice for F/E Electronics	Complete	Complete
	Tile L2/3	Start Module Construction	Complete	Complete
	Tile L2/4	Start Prod of MBs	Complete	Complete
	Tile L2/5	All Electronic Components Delivered to ATLAS	1-Oct-02	1-Mar-03
	Tile L2/6	Module Construction Complete	Complete	Complete
	Tile L2/7	All Modules Delivered to CERN	2-Dec-02	31-Jan-03



Tile Milestones

Level 4 Milestones (Baseline Scope)

WBS	Schedule Designator	U.S. ATLAS Responsibility Completion Description	ETC 02 Baseline Scope Completion Date	ETC 03 Baseline Scope Completion Date	ATLAS Required Date	ETC 03 Planned Float (Months)
Tile						
1.4.1	Tile L4/1	Submodules Production Complete	Complete	Complete	8/01	N/A
	Tile L4/2	EB Module Ship to CERN Complete (Qty. 40)	Complete	Complete	7/02	N/A
1.4.2	Tile L4/3	Optics Instrum at ANL & MSU Complete	10/02	2/03	9/03	7
1.4.3	Tile L4/4	PMT Ship to ATLAS Complete	1/02	7/03	7/03	0
1.4.3	Tile L4/5	Readout Ship to ATLAS Complete	8/02	3/03	7/03	4
1.4.4	Tile L4/6	Gap Submodules Ship to ANL & BCN Complete	Complete	Complete	8/01	N/A
1.4.1	Tile L4/7	Submodules Construction Compl (Qty. 576)	Complete	Complete	7/02	N/A
1.4.1	Tile L4/8	EB Module Ship to CERN Complete (Qty. 64)	12/02	1/03	1/03	0
1.4.4	Tile L4/9	Gap Submodules Ship to ANL & BCN Complete (Qty. 128)	Complete	Complete	7/02	N/A